Combining ability analysis in bread wheat (*Triticum aestivum L.)* under heat stress condition.

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Abstract

Eight diverse parents and their 28F1's crosses of bread wheat genotypes were made in half diallel fashion and conducted in RCBD with three replications during rabi 2019-20. Parent Raj3777 showed also good general combiner as their GCA effect as well as per se performance for anthesis to maturity, total tillers/plant, flag leaf area, spike length, grains/spike, biological yield/plant and grain yield/plant but Raj 3765 only for flag leaf. SCA effects and performance, PBW502 x Raj3777 possessed good super combinations for grain yield/plant and related components and cross PBW502 x Raj3777 recorded as high x low parental GCA effects indicating non-additive effects. Designed for wheat improvement by hybridization scheme, biparental mating could be useful in further manipulation of genes for economic purposes.

Key words:

Combining ability, GCA, SCA, Bread wheat, Stress.

Introduction

Bread wheat (*Triticum aestivum L.* EM Thell.) is one of the most widely adapted food crops in the world. It is the leading crop in the temperate climates. Wheat production is significantly affected by abiotic stress especially at high temperature during the grain filling stage. Heat stress during crop growing period, predominantly at germination and grain filling stages are restricts wheat production and productivity. The common approach of selecting the parents on the basis of per se performance and local adaptation does not necessarily lead to much gainful results because the ability of the parents to continue well depend upon the complex interactions among the genes and genotype x environment interaction. Many scholars have reported GCA and SCA effects for yield and its component in wheat. The present study was carried out to identify the best combining ability of genotypes and their crosses on heat stress tolerant with different traits related to heat tolerance with yield and its contributing traits.

Materials and Methods

Eight genotypes (PBW343, PBW502, Raj3777, Raj3765, HD3086, Raj4238, PBW550 and WH1021) with their genetic diversity, heat tolerance and suitability for yield traits, were crossed in half diallel. Two different dates of sowing used i.e. timely sown and late sown with 3 replications in RBD during 2019-20. The plot for parents and F1's represented two rows and 2.5 m length with 30 cm spaced apart and 10cm interplant distance. Data was recorded on ten randomly selected plants from each plot in each replication of parents and F1's in two environments separately on 15 distinct characters, except days to anthesis, days to maturity and anthesis to maturity, where it was observed on complete plot basis. Data for days to anthesis, days to maturity, anthesis to maturity, plant height, total tillers/ plant, productive tillers/plant, flag leaf area, spike length, grains/spike, 1000-grain weight, biological yield/plant, grain yield/plant, harvest index, proline content and chlorophyll content were recorded for statistical analysis. The mean value of the recorded data was subjected to ANOVA using the standard procedure. Combining ability analysis was done by using Method II and Model I.

Results and Discussion

Estimates of GCA and SCA effects frequently changed from environment to environment, complicating the problem of identification of promising parents and crosses. Significant differences of GCA and SCA indicated that both additive and non-additive gene effects have played an important role in the genetic control of the traits under study.

On GCA effect, PBW550 for days to anthesis, days to maturity and plant height; Raj3777 for anthesis to maturity, total tillers/ plant, flag leaf area, spike length, grains/spike, biological yield/ plant and grain yield/plant and Raj3765 and WH1021 for flag leaf possessed high desirable GCA effects in both the environments. GCA effects, good general combiners had fixable component of variance like additive and additive x additive epistasis component; therefore, parents offer the best possibilities of exploitation for development of improved high yielding lines with heat tolerance in bread wheat. The parents Raj3777, Raj3765 and PBW343 in E1 and Raj3777, Raj3765 and Raj4238 in E2 appeared as good general combiners for grain yield and related traits. Similar findings reported by in wheat.

Peruse the crosses, Raj4238 x PBW550 for athesis to maturity; PBW502 x WH1021 for total tillers/plant, productive tillers/ plant, proline content and chlorophyll content; Raj3777 x PBW550 for productive tillers/plant; Raj3765 x HD3086 for productive tillers/plant and proline content; Raj4238 x WH1021 for productive tillers/plant and proline content; PBW343 x Raj4238 for spike length, biological yield/plant and chlorophyll content; Raj3777 x HD3086 for flag leaf area and grains/spike; PBW343 x HD3086 for grains/spike and grain yield/ plant; PBW343 x PBW550 for grains/spike, grain yield/

plant and proline content; PBW502 x PBW550 for grains/spike; Raj3777 x Raj4238 for grains/spike and PBW343 x PBW502, PBW502 x Raj3777and Raj3765 x WH1021 for proline content showed desirable SCA estimates consistently across the environments.

The crosses PBW502 x Raj3777, PBW343 x HD3086 and PBW343 x PBW550 in E1 and PBW502 x WH1021, PBW343 x HD3086 and PBW343 x PBW550 in E2 appeared as good specific cross combinations for grain yield and some related traits. If parents are good general combiners, high SCA might be due to accumulation of dominant alleles from both the parents, easily exploited in self-pollinated crops by selecting transgressive segregates in segregating generations. SCA evidenced that a good cross combination is not necessarily the result of good x good general combiners; rather it might occur from good x poor or poor x poor combiners as well. In wheat crop, cross\ combinations involving good x good general combiner parents are of greater relevance, because of genes controlling these effects may be fixed in the end product of a breeding programme.

Finally, the cross PBW502 x Raj3777, PBW343 x HD3086 and PBW343 x PBW550, PBW343 x HD3086 and PBW343 x PBW550 recorded as high x low parental GCA effects indicating non-additive effects. Designed for wheat improvement by hybridization scheme, biparental mating could verify to be effective alternative approach for tangible advancement of grain yield in bread wheat.

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